

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE STATE OF WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY, E. A. BIRGE, DIRECTOR; THE COLLEGE OF AGRICULTURE, UNIVERSITY OF WISCONSIN, H. L. RUSSELL, DEAN; A. R. WHITSON, IN CHARGE SOIL SURVEY.

SOIL SURVEY OF JACKSON COUNTY,
WISCONSIN.

BY

W. J. GEIB, IN CHARGE, A. L. GOODMAN, G. W. MUSGRAVE
AND C. B. CLEVENGER, OF THE U. S. DEPARTMENT OF
AGRICULTURE, AND T. J. DUNNEWALD, OF THE
WISCONSIN GEOLOGICAL AND NATURAL
HISTORY SURVEY.

THOMAS D. RICE, INSPECTOR, NORTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1918.]



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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., April 26, 1921.

SIR: I have the honor to transmit herewith the manuscript report and map covering the soil survey of Jackson County, Wisconsin, and to recommend that they be published as advance sheets of Field Operations of the Bureau of Soils, 1918, as authorized by law. This work was done in cooperation with the Wisconsin Geological and Natural History Survey and the College of Agriculture, University of Wisconsin.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

HON. H. C. WALLACE,
Secretary of Agriculture.

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MAP.

Soil map, Jackson County sheet, Wisconsin.

SOIL SURVEY OF JACKSON COUNTY, WISCONSIN.

By W. J. GEIB, In Charge, A. L. GOODMAN, G. W. MUSGRAVE, and C. B. CLEVENGER, of the U. S. Department of Agriculture, and T. J. DUNNEWALD, of the Wisconsin Geological and Natural History Survey.—Area Inspected by THOMAS D. RICE.

DESCRIPTION OF THE AREA.

Jackson County is located in the west-central part of Wisconsin. It has an extreme length east and west of 42 miles. The eastern part of the county is only 18 miles wide, while the western two tiers of townships give the county a width of 36 miles. The included area is approximately 1,001 square miles, or 640,640 acres.

The surface features of Jackson County fall into two very distinct divisions. The approximate boundary between the zones is marked by the Black River from the southwestern corner of the county to a point 3 miles north of Black River Falls. From this point northward the Chicago, St. Paul, Minneapolis & Omaha Railway marks the dividing line. The first division, including that part of the county west of the line mentioned, consists of a thoroughly dissected plain, the stage of development being mature.

At one stage in its geological history the region had a smooth surface with steep slopes bordering it. The lower magnesian limestone which originally covered this part of the county has practically all been removed by erosion, and remnants of the elevated plainlike surface have been reduced to very narrow, winding, irregular ridges on which outcroppings of sandstone are frequent. In but few cases in the county is there any tillable land on the narrow crest of these high ridges. The heads of streams of one drainage system have interlocked with adjacent systems, so that the watersheds are crooked, rocky ridges.

This gives the county a rough, rugged appearance, the greatest irregularity of surface being along the western extremity of the county and becoming less pronounced eastward to the Black River.



FIG. 1.—Sketch map showing location of the Jackson County area, Wisconsin.

The second division, covering the eastern portion of the county, consists of a very extensive sandy plain with a nearly level surface from which arise numerous cliffs of sandstone more resistant than the bulk of the underlying rock. These mounds form a conspicuous feature of the landscape. Much of the eastern portion of the county within this sandy plain is low and poorly drained, and includes extensive marshy areas made up largely of Peat. These marshy areas are most extensive in the extreme eastern tier of townships, where 75 to 80 per cent of the land area is marsh land. Outside of the marshy tracts, except in the regions where shale occurs with the sandstone and along the flood plains of streams, the natural drainage is well established.

The Black River, which enters the county near the center of the northern side and leaves at the southwestern corner, receives the drainage waters from the greater part of the area. From the east it receives the waters from the East Fork of the Black River, Morrison Creek, Perry Creek, Robinson Creek, and others, while from the west it receives Halls Creek, Town Creek, Roaring Creek, and Douglas Creek. The extreme western border of the county is drained westward, chiefly through tributaries of the Trempealeau and Beef Rivers, into the Mississippi. From the southeastern part of the county some of the drainage water reaches the Wisconsin River through the Lemonweir River and its tributaries.

The first settlement in Jackson County was made in 1818 or 1819, when a sawmill was erected on Town Creek, but this was not permanent. The Indians did not cede their right to the region until 1838, and in 1839 the first permanent settlement was made on the present site of Black River Falls. The Mormons built a mill here in 1843, which they operated for part of two years. Later a Mormon settlement was established at Knapp, in the country to the east of Millston. Jackson County was organized in 1853, and the village of Black River Falls was incorporated in 1866.

Black River Falls, with a population of 1,796 in 1920, is the county seat of Jackson County and also the largest city. It is situated on the Black River, near the center of the county, and is a distributing center, market, and shipping point for a large territory. Merrillan, with a population of 628; Taylor, with 313, and Hixton, Hatfield, Pray, and Millston are smaller railroad towns.

Two railway systems traverse the county. The Chicago, St. Paul, Minneapolis & Omaha line crosses the area from the southeast to the northwest, passing through Millston, Black River Falls, and Merrillan. From Merrillan a branch runs northeast through Neillsville, Marshfield, and Wausau to Green Bay. From Fairchild, just above the north county line, a branch extends west through the northern

parts of Jackson and Trempealeau Counties to Mondovi, in Buffalo County. The Green Bay & Western Railroad crosses the county from east to west, passing through Pray, Hatfield, Merrillan, Hixton, and Taylor. The southwestern corner of the county is more remote from railroad facilities than any other section of the area, but this has not prevented its development. In fact, this is one of the best improved and most highly prosperous farming communities in the county and centers about the inland town of Melrose, which is connected with Black River Falls by stage.

At Hatfield there is a large dam across the Black River just above the rapids, and this forms an extensive reservoir known as Lake Arbutus. A power house is located several miles south of the dam, and from here the electric power is carried over high-tension transmission lines to La Crosse and other points.

The main dirt roads throughout the western part of the county are usually graded and kept in good condition, as the predominating soil material makes a good road bed; but hills are numerous and grades are frequently steep, so that heavy hauling is difficult. Throughout the sandy part of the county most of the roads are very sandy, but in some instances shale or clay, where available, have been used in improving the highways with very satisfactory results.

Nearly all parts of the county are supplied with rural free delivery service, and telephones are common throughout the region.

The towns within the area afford markets and shipping points for the farm produce raised. From Black River Falls to Madison it is 127 miles, to Milwaukee 209 miles, to Chicago 250 miles, and to Minneapolis 152 miles.

CLIMATE.

The following table gives the average temperature and rainfall conditions as recorded by the Weather Bureau station at Hatfield, in the north-central part of the county, on the Green Bay & Western Railroad.

Normal monthly, seasonal, and annual temperature and precipitation at Hatfield.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1910).	Total amount for the wettest year (1911).
December.....	° F.	° F.	° F.	Inches.	Inches.	Inches.
	19.2	62	-36	1.37	.99	3.51
January.....	13.6	53	-43	.85	.72	1.64
February.....	14.4	56	-38	.88	.45	1.50
Winter.....	15.7	62	-43	3.10	2.16	6.65

Normal monthly, seasonal, and annual temperature and precipitation at Hatfield—Continued.

Month.	Temperature.			Precipitation.		
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1910).	Total amount for the wettest year (1911).
March.....	° F. 28.8	° F. 80	° F. -28	Inches. 1.28	Inches. T. .50	Inches. 2.05
April.....	46.9	89	8	2.42	3.85	2.11
May.....	58.3	93	20	4.78	2.20	7.45
Spring.....	44.7	93	-28	8.48	6.05	11.61
June.....	66.2	100	28	4.34	.50	5.50
July.....	70.1	100	31	4.02	2.03	5.42
August.....	66.9	98	30	3.38	3.66	4.77
Summer.....	67.7	100	28	11.74	6.19	15.69
September.....	60.3	98	21	3.69	2.41	6.79
October.....	48.7	87	4	2.93	.90	7.36
November.....	32.4	74	-16	1.66	1.36	1.51
Fall.....	47.1	98	-16	8.28	4.67	15.66
Year.....	43.8	100	-43	31.60	19.07	49.61

The table shows that the mean average temperature for the spring months is 44.7° F., for the summer months 67.7° F., and for the fall months 47.1 F°. Hot or dry spells frequently come in July or August. The average date of the last killing frost is May 20, and of the first in the fall is September 21, giving an average growing season of 124 days, although frosts have occurred in every month of the year, especially in the marshy region. The average rainfall is 31.6 inches, most of which comes during the growing season.

AGRICULTURE.

Agriculture in its beginnings followed close on the heels of the lumberman. Pine forests lined the Black River and covered the eastern half of the county. During the process of marketing this timber, railroads were built and sawmills established, and towns grew up around the sawmills and lumber camps. Roads were opened from town to town, and the land seeker was attracted to the locality.

The first extensive settlement began about 1850. Wheat was the popular crop at first, because it always found a market. Many farmers hauled their wheat 20 to 40 miles or more with ox teams to the nearest railroad point. Wheat growing was confined to the western half of the county, where most of the soil is heavy and better adapted to grains than that of the eastern half.

By 1880 there were 1,600 farms, and the number has increased to 2,577 at the present time. Since 1880 wheat growing has declined heavily, while the production of oats, corn, barley, and rye has largely increased. Owing to the decrease in yields from too continuous growing of wheat, and also because of low prices and plant diseases, the production fell off. As communication and marketing facilities improved, live stock and dairy farming came to the front. Much more live stock is sold from the farms now than formerly, and cheese factories and silos are generally distributed in the western half of the county, though grain raising still holds a large share of the agricultural activity of several of the townships.

At the present time the agriculture of the western half of the county is partly general farming and partly dairy farming, with grain raising leading in certain portions but gradually giving way to the former two. The agriculture of the county east of the Black River, except for small areas where the better grades of soil predominate, is still largely in an undeveloped state. While centers of farming have started around the areas of better soil and around a few small towns, most of the land is still covered with brush and is not farmed. This is due in large part to the poor quality of the soils. Groups of farms are found near Shamrock, Millston, City Point, Pray, and Hatfield, and also in the vicinity of Oak Ridge and Knapp in the interior of this part of the county.

The main crops of the western half of the county are the small grains, corn, and hay, which are largely fed to cattle. The cash crops consist of tobacco, beans, potatoes, and rye, and on some farms barley, wheat, and oats.

East of the river live-stock raising does not thrive so well because of the inferior pasturage produced, except on the patches of better soil. Clearings are small. Only a few head of stock are kept, and a little oats, rye, and some corn are produced. Other sources of income are picking blueberries and working on the cranberry marshes.

Of the agricultural products of the county, as a whole, the cereals lead by far. The value of the cereals in 1920 was \$3,044,915, while hay and forage were worth \$1,936,151. The total value of all domestic animals was \$3,573,585, and the value of dairy products, excluding those used on the farm, amounted to \$1,620,125. Among the cereals, as reported by the 1920 census, oats represents the greatest acreage and production, with corn second, and rye third, closely followed by wheat. There is a fair acreage of barley and buckwheat.

In 1920 there were 40,613 acres in oats and 17,177 acres in corn. The towns¹ of Garden Valley, Albion, Franklin, Irving, Curran, Melrose,

¹ The term town, as used in this survey, is synonymous with township.

and Northfield produced the most grains, hay, corn for silage, and tobacco, and have the most cows, horses, sheep, and silos. The soil in these towns is largely the Union silt loam.

The towns of Cleveland, Hixton, Alma, and Springfield, with largely fine sandy loam and loam soil, led in acreage of corn for grain, alfalfa, buckwheat, beans, and wild hay, and were second in number of hogs, silos, and acres of wheat, tobacco, silage, and potatoes.

The towns with largely medium to sandy soil, including Garfield, City Point, Manchester, and Komensky, led in the production of rye, wild hay, and clover. Brockway, Millston, Knapp, and Bear Bluff, the most generally sandy towns, led in acreage of potatoes, cranberries, and wild hay. Being only partly developed, they do not compare with the production of the more highly developed towns having heavier soil.

Tobacco is the most valuable special crop grown in the county. The census of 1920 reports 414 acres, with a production of 578,829 pounds, and the State census of 1917 reported 550 acres devoted to tobacco growing in the county. The acreage on any one farm is small and probably does not average more than 2 or 3 acres, so that tobacco is grown on from 200 to 250 of the 2,577 farms in the county.

The largest yield of tobacco is generally obtained on the silt loam or loam soils, but the best quality of leaf is grown on the fine sand and fine sandy loam soil. The farms where the heavier soil predominates are generally busy with dairying and grain production, and sufficient help for the hand work needed on tobacco can not be spared.

On the fine sand farms, however, pasture is less abundant, grain yields are reduced, fewer cows are kept, and the farms are often smaller, so that hand labor for tobacco growing can be spared better, and most of the tobacco is grown, therefore, on the lighter soils.

Tobacco has been grown for nearly 20 years. The industry was introduced by the Norwegians from the tobacco-growing districts of the southern part of the State. Tobacco land must be kept in a high state of fertility, so that it is desirable that stock be kept to furnish the manure. One danger in tobacco raising is that all the manure of the farm is likely to be concentrated on the tobacco fields and the other fields allowed to run down in fertility.

Comstock Spanish and Golden Spanish are the varieties most generally grown. Yields of 1,200 to 2,000 pounds per acre are secured. The crop is contracted for in spring at a certain figure or is bought from the curing shed at the prevailing market price by buyers who visit the farms and inspect the product. The leaves, when dried, sorted, and the stems removed, are tied in bundles and compressed into bales for shipment.

No diseases of tobacco have yet appeared in this district as they have farther south. The enemies of the plant in this section are hail storms and early frosts, which are liable to injure the quality of the leaf. It is usually harvested from September 5 to 15. The crop rotation usually followed consists of tobacco on the same field 2 to 6 years, then corn, then grain.

The production of cranberries is a special industry carried on chiefly in the marshy parts of the eastern half of the county. The 1920 census reports 480 acres of cranberries, with a yield of 548,648 quarts.²

In 1919, 232 acres were in beans in Jackson County. Beans also are generally grown on the sandy soils and in small plots of one-half to two acres, although a few fields of from 5 to 20 acres of beans are grown. The white navy bean is the variety generally grown. The greatest acreages reported were in the towns of Alma, Albion, Hixton, and Garfield.

Potatoes are produced on a commercial scale in several parts of the county. In 1919, 2,411 acres were reported. The largest acreages are found in Cleveland, Irving, Garden Valley, Garfield, and Alma Towns. Potato warehouses are located at Price, Black River Falls, Alma Center, Levis, and at Humbird (Clark County), and Fairchild (Eau Claire County).

Cucumbers are quite extensively grown in parts of the county, chiefly on the sandy and sandy loam soils. Pickle stations are located at Merrillan, Black River Falls, Hatfield, Levis, and Taylor. As high as \$2 per bushel of 50 pounds is paid for first-grade cucumbers. Seed is generally furnished. The crop has proved profitable in favorable seasons when grown on suitable soil. This crop is very tender, and occasional early frosts in the fall or late summer practically destroy the cucumbers or greatly reduce the yield.

As to any general recognition among farmers of the adaptation of crops to soil, it is widely known that the so-called clay or Union silt loam country is very well adapted to grain growing and to grass, while the sandy soils are adapted to the special cash crops, such as cucumbers, beans, potatoes, and tobacco.

Topography also has a general effect on the crops raised, especially in the western part of the county. Where the land is very rolling, with much steep land and Rough stony land included, the Union silt loam is used most extensively for grain raising or for general farming, together with fattening young stock and sheep. But where the topography is more undulating than rolling, more corn can be grown without danger of erosion, and cultivation is easier; so that silos are

² For a full discussion of this industry attention is directed to Buls. 119, 213, and 219, Wis. Expt. Sta.

more abundant, more cattle and hogs are kept, and the output of dairy products is greater.

In some sections live-stock raising largely displaces grain growing, and in other areas dairy farming has already displaced the other two, although combinations of all three lines of farming can be found in almost any neighborhood in the western part of the county.

In 1917 the most beef cattle were found on the farms of Northfield, Irving, Albion, and Garden Valley Towns. There are 25 creameries and cheese factories, located chiefly in the western half of Jackson County, and the number of these is increasing.

Crop rotations must be adjusted to fit the different kinds of farming, but the most general rotation consists of corn, followed by small grain (such as oats, barley, wheat, or rye) one year or possibly two years, after which the land is seeded to clover and timothy, from which hay and pasture are derived generally for two years before planting to corn again.

Lodging of grain is a serious problem in some districts. This is relieved to some extent by keeping the land in grain two years in succession, the grain usually standing up much better the second year.

The farm buildings and equipment in the Union silt loam and Boone fine sandy loam and loam country are generally modern and up to date. In the vicinity of Melrose and on the northern side of Trempealeau River Valley, large barns and silos, electric lights, and water-supply systems are common. A number of farms use tractors, although the amount of steep and rough land precludes the use of some types of tractors for field work.

In the more sandy districts the farm buildings are less pretentious, as a rule, occasional abandoned farms are seen, and equipment and machinery are often of a less complete order. Although there are sometimes very good buildings and equipment on sandy farms, the condition of these is usually a fair indication as to the fertility of the soil or the profitable nature of the farming done.

Labor on farms is largely American born, obtained from the immediate locality. Prewar wages varied from \$30 to \$40 with board, although during the last few seasons as much as three times this price has been paid, owing to war conditions. In general, farm help is scarce, and the special crops, such as tobacco and cucumbers, have been reduced in acreage on many farms because of the labor shortage.

Of the 2,577 farms in Jackson County reported by the United States Census of 1920, the greatest number, 991, were between 100 and 175 acres in size, 622 were 50 to 99 acres in size, and 425 were 175 to 260 acres in size. Moderate to large sized farms are the rule,

although where special crops are grown exclusively the farms are often much smaller.

Eighty-six and three-tenths per cent of the farms are operated by owners, 12.7 per cent by tenants, and 1 per cent by managers.

Farm values differ greatly. The best land in the well-developed Union silt loam country often sells for \$100 to \$200 an acre, while an occasional wooded, poorly located piece can be bought for \$35 to \$40. In the eastern half and the sandy districts wild land may be had for \$5 to \$15 an acre, and partly developed land for from \$20 to \$30.

SOILS.³

Jackson County lies almost entirely within the unglaciated part of Wisconsin, and in its geological formations, soil conditions, and topography it is representative of large areas in the central and southwestern parts of the State. The topography of the western part of the county is comparatively old and was well established before the materials constituting the majority of the present soils were laid down.

Throughout nearly all of the county the uppermost rock is Potsdam sandstone. Over the western part of the area this rock outcrops in numerous places, forming the steep rocky slopes of valley walls, isolated mounds, or long, narrow ridges where the rock has been more resistant. In the eastern part of the county there are also numerous isolated mounds of sandstone which form a conspicuous feature of the landscape. The outcroppings of this rock make up a considerable portion of the type mapped as Rough stony land. Granitic rocks form the bedrock formation along the Black River from Black River Falls north. In the immediate vicinity of City Point, in the extreme eastern part of the county, the surface rock is also granite.

The soils of the whole county may be considered as derived from unglaciated material, but along the extreme northern border of the county there are various indications of glaciation. These are chiefly glacial bowlders and gravel in places. No pronounced moraine is found there. The glaciation represented is pre-Wisconsin, and, because of its extreme age and the weakness of its action along the southern border, its influence on the present-day soils is not sufficient to recognize in our soil classification of Jackson County.

³ Jackson County adjoins La Crosse County on the south and Wood and Juneau Counties on the east. In certain cases the maps of these counties do not appear to agree along the boundaries. This is due to changes in correlation, resulting from a fuller knowledge of the soils of the State. Soil materials undifferentiated on the older maps, such as Meadow and Sand and Peat, have been separated into types in this area. The Wabash types are now mapped with the Genesee series and the Whitman soils with the Vesper or the Dunning series.

The soils of this county are grouped into soil series on the basis of color, origin, topography, and structural characteristics. Ten series are represented. The series are divided into types on the basis of texture or the proportion of sand, silt, and clay particles. Nineteen types, including Peat and Rough stony land, are mapped in this area.

The surface of nearly all of the western part of the county is covered to a depth varying from less than 2 feet to more than 10 feet, with a mantle of silty material which is undoubtedly loess. It is silty at the surface, but the clay content gradually increases with depth. In cuts a laminated structure is often observed.

At one time the entire western part of the county was doubtless covered with this material. It has been removed by erosion in places, especially where the deposit was thin, and the underlying sandy material or sand rock is exposed. The soil derived from this loessial blanket has been classified as Union silt loam. The Union series consists of types with brown to grayish-brown surface soils and yellowish-brown, moderately friable subsoils.

The Bates series comprises dark-colored upland soils in the loessial region, where the original timber was thin or sparse and where a semi-prairie condition prevailed. The silt loam is the only type mapped.

On many of the slopes in western Jackson County and over extensive tracts in the eastern part of the area the material forming the soil has been derived directly from the weathering of the Potsdam sandstone. This material has been classified as the Boone series. The Boone loam, fine sandy loam, and fine sand, with several phases, are indicated on the soil map.

In a number of places, especially in the northeastern part of the county, the Potsdam sandstone has some shale associated with it, and from the weathering of this material has come the Vesper series of soils. The surface is level, the soils are shallow over the shaly rock, and usually contain varying quantities of clayey material in the subsoil derived from the shale. The types mapped are Vesper silt loam, fine sandy loam, and sandy loam.

Along stream valleys throughout the loessial region some terraces occur where the soil is rather heavy and has been derived from the loess and redeposited by water. These soils are of the Lintonia series, represented in this area by one type, the silt loam.

Along Black River and its tributaries are extensive tracts of alluvial land, now found as terraces well above the present flood flow. The soil is light colored and light in texture and has been classified as the Plainfield series. The types mapped are Plainfield sandy loam, sand, and fine sand.

Throughout the eastern part of the county are numerous areas of marsh border soil which are dark colored, low lying, and naturally poorly drained, and where the soils are of a sandy nature, partly residual and partly alluvial, and always acid. These soils are placed in the Dunning series, represented here by the Dunning sand.

The first-bottom, light-colored soils, subject to annual flooding, have been classified as of the Genesee series, of which two types, the silt loam and fine sandy loam, were mapped.

Extensive areas of Peat were also mapped. This consists of decaying vegetable matter in various stages of decomposition, with which there is mixed a small quantity of fine earth, but seldom enough to permit the use of the term Muck.

In the stream bottoms of the western part of the county, where the soils are dark-colored and rather heavy in texture, they are classed in the Wabash series. The poorly drained phases of the Wabash loam and silt loam were mapped.

The following table shows the actual and relative extent of each soil type, and in the following pages of this report each type is fully described.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Boone fine sand.....	111,744		Wabash silt loam, poorly drained phase.....	7,808	1.2
Level phase.....	14,656	20.1	Wabash loam, poorly drained phase.....	7,488	1.2
Poorly drained phase.....	2,176		Genesee silt loam.....	7,296	1.1
Union silt loam.....	73,920	18.9	Vesper silt loam.....	4,800	.8
Steep phase.....	47,296		Genesee fine sandy loam.....	3,072	.5
Peat.....	89,536	15.7	Bates silt loam.....	2,624	.4
Shallow phase.....	10,752		Lintonia silt loam.....	2,368	.4
Boone fine sandy loam.....	54,400	8.5	Vesper sandy loam.....	2,368	.4
Rough stony land.....	42,496	6.6	Plainfield sandy loam.....	1,536	.2
Vesper fine sandy loam.....	40,000	6.2	Total.....	640,640	
Dunning sand.....	37,888	5.9			
Plainfield sand.....	35,136	5.5			
Boone loam.....	22,400	3.5			
Plainfield fine sand.....	18,880	2.9			

UNION SILT LOAM.

The surface soil of the Union silt loam consists of about 12 inches of a grayish-brown or buff-colored silt loam, having a friable structure and a smooth feel. While there is present a small percentage of fine and very fine sand, but few coarser grains are found. On drying, the surface becomes ashen in appearance, and the lower portion of the soil usually is of a yellowish color. As a whole, the texture of the material is very uniform. The subsoil consists of a heavy yellow silt loam, grading into a silty clay loam at 18 to 20

inches, and usually becoming a light chocolate brown color at 30 to 36 inches. It is compact and is uniform throughout its entire extent, except as indicated in the steep phase described below. The underlying rock lies from 4 to 10 or more feet below the surface.

The most important variation in this soil has been designated the steep phase on account of its steep slopes and rough, uneven topography. A description of this phase follows the description of the typical soil.

Minor variations in the typical soil occur, chiefly on the narrow ridges, where the surface soil has been removed in places and the heavy subsoil exposed. In such places the depth to the underlying rock is also less than over the more extensive areas of this type, and in some instances it can be reached with a 3-foot auger. On some of the lower slopes the wash from the adjoining higher land has accumulated to a small extent and the surface soil in such places is somewhat deeper than the average. On some slopes the soil is a little darker in color and contains more organic matter than typical.

While a number of such minor variations occur, this soil, taken as a whole, is remarkably uniform. The Union silt loam all lies west of the Black River and the towns of Black River Falls and Alma Center. This is an important and extensive type of soil in Jackson County, the towns of Melrose, Franklin, Garden Valley, Albion, Irving, Curran, and Northfield being largely made up of it.

The Union silt loam occupies a series of hills and ridges. The typical Union silt loam is found on the tops of these elevations, where the surface is nearly level to gently rolling, and also on the more gentle slopes, where erosion is not a serious problem and ordinary farm operations can be carried on without difficulty. On the steep phase the fields are subject to erosion and the operation of farm machinery is more difficult.

The topography is such that drainage on this soil is almost always efficient and only in isolated spots will it ever need to be improved by tiling. The type is quite retentive of moisture, but suffers from drought during long dry spells.

The Union silt loam in Jackson County lies directly over sandstone rock, which underlies all the ridges and knolls at from 2 to 10 feet beneath the surface. The surface soil is of loessial origin, having been deposited as fine dust by winds from the south and west in past geologic ages. It is often noticeable that slopes which would be exposed to such winds are but thinly covered with the silt loam, or the soil is sandy, while in the lee of hills and ridges the silt loam surface soil is often deeper than ordinary.

Most of this soil shows varying degrees of acidity—so much so that there will generally be difficulty in getting alfalfa started unless the soil is limed.

The native timber on this soil in Jackson County consisted mainly of white oak, black oak, and bur oak, with some white birch, basswood, maple, and white pine. Most of the soil having a fairly level or undulating topography has been cleared and cultivated for many years. A large part of the steep phase is still forested, as are a few of the more isolated areas which are not steep. The timber is mostly second-growth oak, poplar, and white birch.

The principal crops grown at the present time and the average yields obtained are as follows: Corn, 40 to 45 bushels; oats, 35 to 45 bushels; barley, 30 to 35 bushels; wheat, 20 to 25 bushels; and hay, 2 to 2½ tons per acre. Oats are grown more extensively than any other grain crop.

The acreage of barley is smaller than that of oats, and the area devoted to wheat is still less. The quality of the small grains grown on the Union silt loam is excellent, and this soil is generally held to be a better grain soil than any of the other soils of Jackson County. Corn, on the other hand, does not do so well on this type as on the darker colored soils of the Wabash or Bates series, though the crop is successful wherever grown on this soil. Most of the small grain and corn is fed to stock on the farms, though elevators at Hixton, Fairchild, and Taylor, and numerous grist mills handle much oats and barley and some wheat. Where the land is well farmed, little trouble is experienced in growing clover, but when the snowfall is light, the alternate freezing and thawing of the ground sometimes kills out this crop. Pasturage, in general, is excellent, being scant only in very dry weather or on shallow slopes or knolls exposed directly to the sun.

Buckwheat, rye, and sorghum are produced on this soil, but their acreage is never large. Potatoes are grown for home use on practically every farm, but seldom on a commercial scale. Tobacco, beans, and peas are not extensively grown on this type, being confined chiefly to soils of lighter texture. Garden crops, such as strawberries, tomatoes, lettuce, radishes, and cucumbers, and bush berries all do well and are grown for home use, but seldom on a commercial scale.

Fruit growing is not an important industry, though most farms have a few fruit trees and there are a few fairly large orchards.

Farm buildings are generally in good condition, and silos are rapidly coming into general use, especially in the towns of Albion, Springfield, Hixton, North Bend, and Alma.

Large numbers of cattle, hogs, and calves are raised and sold as a part of the business of dairying. Stock buyers located at Fairchild,

Black River Falls, Hixton, Taylor, and Humbird operate over adjoining territory.

The rotation of crops most commonly practiced is one consisting of a small-grain crop with which clover and timothy are seeded, hay being cut for two years, after which the land is plowed for corn. When wheat is grown it may take the place of the second grain crop. Hay may be cut for two years, or the field may be pastured one year after being cut for hay the first year. On the steep slopes corn is sometimes omitted from the rotation, because the land is more apt to erode when in an intertilled crop than when in a grain crop or in grass. The steeper slopes are usually kept in grass for the greater part of the time, though some attempts are made to cultivate crops on land of this character. Stable manure is usually applied to the sod to be plowed for corn.

Nearly every farmer produces enough potatoes for home use, and many have some to sell each year. The yield is usually about 150 bushels per acre. The soil is not as well adapted to this crop as are some of the other types, especially the sandy loams, though the quality of the potatoes grown is fair.

Tobacco was at one time more extensively cultivated than at present. It is generally grown on the same field for four years in succession, but the yields are best during the first two or three years. The fields must be heavily manured, and this is done at the expense of the remainder of the farm. Tobacco usually follows potatoes or corn and is itself followed by wheat. The yields range from 1,000 to 1,600 pounds per acre. Since the crop requires careful attention and considerable labor, the acreage devoted to it on any farm is comparatively small.

Alfalfa is being tried by a few farmers, and some have secured a good stand without inoculating the soil. In order to secure the best results, however, the soil should be inoculated. Barnyard manure should be applied liberally, and liming is also necessary, since the type is slightly acid.

Trucking and small-fruit growing are not carried on to any great extent, though the ordinary garden vegetables and berries are grown for home use, and limited quantities are marketed in the near-by towns. There are a few small apple orchards, but the fruit industry has not received special attention on this soil.

In cultivating this type it should be kept in mind that the soil is low in organic matter and that much of it is subject to erosion. The supply of organic matter may be increased by supplementing the stable manure with green crops, especially legumes, plowed under. The second crop of clover may well be utilized in this way. Erosion may be held in check by putting the steeper slopes in grass. When necessary or desirable to cultivate these slopes the plow should be run

at right angles to the slope. The drainage channel down the hillside is sometimes left as a shallow sod ditch, while the remainder of the field is cultivated.

Union silt loam, steep phase.—In general physical character and appearance the soil of the steep phase of the Union silt loam is essentially like the typical soil, the basis of separation being one of topography. The color and texture may be slightly lighter than that of the typical soil, and the average depth to rock is less. Because of its steep, broken character, this phase has a lower agricultural value than the typical soil.

The steep phase of the Union silt loam is intimately associated with the main type and frequently grades into it in such a way as to make the drawing of a definite boundary line difficult. It occupies steep slopes, generally about the heads of small streams heading in areas above the Rough stony land. On these slopes, which form the sides of the valleys, the silt soil is subject to erosion, and careful methods are necessary to prevent destructive gulch formations while these slopes are under cultivation. Where the steep slopes are not wooded, or in pasture, or covered by a growing crop, the soil is likely to wash badly, and ditches are quickly and deeply cut into the hillsides. When erosion has once started it is difficult to check, so that methods of prevention are very important.

The natural drainage of the steep phase is good, except in small areas along the slopes where springs and seeps may occur. The greater part of it is so rolling that a large percentage of the rainfall runs off, and crops often suffer from lack of moisture.

The Union silt loam, steep phase, has practically the same origin as the typical soil, though as a rule the depth to bedrock is less, and chert fragments sometimes occur on the surface and through the soil mass.

The original forest growth consisted of the same trees as on the typical soil, oak predominating. Most of the standing timber outside of the bottom lands is now found on this phase and on the Rough stony land with which it is associated, though a considerable proportion of the steep land is cleared and either in cultivation or pasture land.

The same crops are grown on the steep phase as on the typical soil, but less corn and other intertilled crops are grown, and more of the land is in grass and pasture than on the main type. The ordinary yields of all crops are somewhat lower. Because of the steep character of the surface the phase is more difficult to work than the typical soil. The steepest portions of the phase are now in forest or pasture, and the remainder is devoted to general farming.

The greatest problem with this soil is to prevent erosion, and the methods suggested for the typical Union silt loam will also apply to

this class of land. The soil is also deficient in organic matter, and this should be supplied by supplementing the stable manure with green manure crops. The type should be kept in grass as much as possible, and dairying and stock raising are the best industries to follow. There are many good orchard sites on this phase, and it is considered a better fruit soil than the typical Union silt loam. Bush berries, strawberries, and similar fruits do well, and it would seem that such fruits might be profitably grown on a commercial scale, since much of the type is within easy reach of shipping points. The growing of apples might also be made successful, though care should be exercised in selecting locations for orchards.

BATES SILT LOAM.

The surface soil of the Bates silt loam, to a depth of 10 to 14 inches, consists of a dark-brown silt loam containing a high percentage of organic matter. Its high percentage of silt and organic matter gives the soil an extremely smooth feel. Litmus-paper tests indicate an acid condition over most of the type. The subsoil consists of a brown or buff-colored silt loam which gradually becomes heavier in texture and lighter in color and at 24 to 30 inches consists of a yellowish-brown, compact, heavy silt loam or silty clay loam. In spots where the drainage is deficient the subsoil shows a slight mottling of light gray or drab. This heavy subsoil extends to a considerable depth and will probably average 7 to 8 feet in thickness.

This type of soil is all found in one locality. It covers 4 or 5 square miles just north and west of Alma Center. The surface is nearly level to undulating, occupies part of the valley flat and extends up adjoining slopes and includes small knolls and elevations. There is sufficient fall so that the drainage is generally good, although where the land is quite level the drainage is deficient in places.

The silty material composing this type of soil may be of residual origin from a shaly phase of the Potsdam formation, but it more probably consists of secondary loessial material. It differs from the Union silt loam principally in its higher organic-matter content. The type as a whole is generally known as "oak openings," having been originally forested with scattered clumps of large oak trees, while the intervening spaces supported a more or less heavy growth of prairie grass.

The Bates silt loam is one of the desirable types of soil in the county. All the general crops grown in the region do well on this type, and the average yields of some of them are considerably higher than on most of the other soils. The soil is especially well adapted to corn, of which the ordinary yield is 50 to 60 bushels per acre.

Barley produces 30 to 35 bushels, and oats 40 to 50 bushels per acre. The quality of the small grains is not so good as of those grown on the Union silt loam. Clover and timothy produce from 1½ to 2 tons per acre, and the pasturage is generally excellent. The rotation of crops generally followed consists of corn, small grains, and hay. Of the small grains, oats is most commonly grown, though barley may also be grown in the rotation following the oats. Where the acid condition is corrected and the soil inoculated, alfalfa promises to do very well.

Dairying is the chief branch of farming followed, and hog raising is carried on quite extensively on many of the dairy farms. The buildings and other improvements on this soil are as a rule better than the average. Some farms produce beef stock in connection with dairy farming. Silos are in general use.

The selling price of farms located on land of this type ranges from \$90 to \$125 an acre, depending upon improvements, nearness to market, and good roads.

BOONE FINE SAND.

The soil of the Boone fine sand, to an average depth of 6 inches, consists of a brown or yellowish fine sand, in the surface inch or two of which there is a small supply of organic matter. The soil is loose and open and is occasionally blown into small dunes by the wind. Sandstone fragments and some chert may occur upon the surface and mixed with the soil. The subsoil consists of a yellow fine sand which contains fragments of sandstone and chert and usually grades into disintegrated sandstone or into the solid rock not far below the surface. The texture may become coarser as the rock is approached. The underlying rock frequently outcrops. The depth to rock is variable and ranges from 1 foot to 5 or 6 feet. Where the depth is greatest rock fragments are seldom found, but where the soil is shallow they may be very plentiful. As a rule, the soil is shallower in the hill country than in a flat region. The subsoil in places has a reddish-brown color, but the type as a whole is quite uniform, and the variations are of minor importance.

The Boone fine sand is widely distributed over nearly all parts of Jackson County. It occurs wherever the loessial or wind-blown silty blanket of soil failed to cover the sandstone, or where the silt surface has been removed by erosion. In the eastern half of the county this soil covers the greater part of the upland. In the western part it is confined largely to the valleys and slopes surrounding the sandstone ridges and outcrops. Pine, Lowe, and Tank Creek Valleys in the towns of Hixton and Albion have a good deal of this kind of soil.

The topography varies from very gently sloping to rolling. On the larger areas of the soil the surface is undulating for the most part, the rolling topography occurring only in the vicinity of the sandstone mounds and ridges. None of the slopes are sufficiently steep to make the prevention of erosion an important factor in the management of this soil.

On account of the surface features and the loose, open character of the soil and subsoil, the natural drainage is excessive, and crops usually suffer from drought during a portion of every season.

In origin the Boone fine sand is largely residual, having been derived from the weathering of Potsdam sandstone. There is but little organic matter present and such a small quantity of silt and clay that the loose surface material is readily blown by the wind, and in a number of places low sand dunes have been formed.

The material composing the type is in an acid condition, as indicated by the litmus-paper test.

The original forest growth on this type consisted chiefly of Norway and jack pine and scattered scrubby oak. Coarse grasses and sand burs are also found growing on the type, though there are a number of places where the surface is bare of vegetation and the soil is now drifting.

The Boone fine sand is one of the most extensive types of soil in Jackson County. While a large part of it occurring in the western part of the county with soils of greater agricultural value is used for some agricultural purpose, a very large part of the soil in the eastern half of the county is not cultivated. Large areas remain covered with brush, bushes, or small trees, and parts once cultivated have been abandoned in many cases. Perhaps 15 to 25 per cent of this soil is cultivated or used for some agricultural purpose. The presence of better types of soil in the vicinity always encourages the cultivation of this soil, but where it occurs exclusively in large areas agriculture does not thrive on it.

Good yields of crops adapted to the soil are often produced in favorable seasons where the land is properly cultivated. Such crops as corn, rye, buckwheat, beans, cucumbers, tobacco, and clover are grown on this soil in different parts of the county. Special crops succeed best because of its easy cultivation, but the land can be very quickly run down and crop yields greatly reduced where methods for keeping up the soil fertility are not employed.

Dairy farming is at a disadvantage unless the cattle can range over a large area of land or unless the farm includes bottom land or heavy soil for pasture, as the Boone fine sand furnishes scant pasturage during the dry parts of the summer.

Tobacco and beans are grown on this soil mainly in the valleys west of Black River in the towns of Springfield, Northfield, Albion,

and Curran. Cucumbers are grown in the towns of Brockway, Alma, and Komensky.

The chief crops grown and the average yields obtained during the most favorable seasons are as follows: Corn, 15 to 20 bushels; oats 15 to 20 bushels; rye, 12 to 15 bushels; buckwheat, 10 to 12 bushels and potatoes, 50 to 100 bushels per acre.

The yields of crops vary greatly depending on the location of the land, the kind of season, and in part on how the land is handled. The best yields are obtained where the land lies in such a position that it does not dry out too readily in the summer months, such as on a north slope or at the base of a slope where run-off and seepage of the rainfall tend to keep the soil moist but not too wet. High yields are also obtained where small patches of this soil are surrounded by heavier soil. On such places the farmer seems to have more manure to spare for the light soil, and he often has better success with clover. A subsoil slightly more compact than normal is sometimes found in these locations.

Very good yields of mammoth clover are sometimes obtained on this soil, and in a number of places clover for seed is regularly grown. Some farmers find that clover sown with oats in the spring does better on this soil than clover sown with rye in the fall. In other locations where this soil is extensive, clover is practically never grown, and a good catch is very difficult to obtain.

Yields of 8 to 10 bushels of white beans and 90 to 125 bushels of potatoes, and profitable yields of tobacco and cucumbers are reported in favorable seasons. The special crops are subject to frosts, and total failures sometimes result from this cause as well as from dry weather. From 1 to 3 or 4 acres per farm is generally the limit where these special crops are grown, although on a few farms the acreages are much larger.

The most successful farmers on this soil raise a small acreage of special crops, and for general crops they grow mainly rye, corn, or buckwheat, and usually are able to grow enough oats for their own use. In some cases a three-year rotation of rye or oats with clover the first year, hay and pasture the second year, and corn the third year, is practiced. Where clover is seldom if ever grown and farm manure is scarce a part of the land is allowed to lie fallow about one year in three. Very little commercial fertilizer is used except for cucumbers. Tobacco is usually heavily fertilized, farm manure being the main fertilizer used.

Land values vary with location and improvements. In the eastern end of the county this soil may be bought as low as \$8 to \$12 an acre, while in other parts as high as \$20 to \$50 an acre is paid for farms having a large proportion of this soil.

A coarser variation of this type is found in an area east of Hatfield and in two small areas, one east and one north of Black River Falls. The soil in these localities ranges in texture from medium to coarse sand. The topography is undulating to nearly level. In other respects the soil in these areas does not differ greatly from the typical soil.

Boone fine sand, level phase.—A part of the Boone fine sand has a surface so generally level that it has been indicated on the soil map as the level phase. In color of soil and subsoil, texture, and other characteristics it does not differ greatly from the typical soil. The depth of the soil material above the original rock from which it was derived is greater on an average than over the more rolling areas.

This phase covers several square miles within the areas of the typical Boone fine sand in the southeastern part of the county. It occurs mainly in Bear Bluff, Knapp, and City Point Towns.

Only a small percentage of this phase is under cultivation at present. In crop yields and agricultural possibilities it ranks with the better part of the typical Boone fine sand.

Boone fine sand, poorly drained phase.—In sections 23, 26, 34, and 35, T. 22 N., R. 3 W., 3 or 4 miles south of Hatfield, and in section 24, $1\frac{1}{2}$ miles east of Black River Falls, are large areas of upland having poor drainage, which are separated as a poorly drained phase of the Boone fine sand. The soil is a dark or white fine to medium sand with a subsoil of varicolored sand. There is no shale or clay layer, although sandstone rock is found at 36 to 40 inches in a few places. Part of the land is cultivated and gives fair yields in the drier seasons. The topography here is level or very slightly undulating.

BOONE FINE SANDY LOAM.

The surface soil of the Boone fine sandy loam, to an average depth of 8 to 10 inches, consists of a grayish-brown fine sandy loam, which in some places contains a considerable quantity of medium sand. The quantity of organic matter present is not large, but a slightly acid condition is found to exist over most of the type. The subsoil consists of a brown to yellow-brown, fine to medium sandy loam which usually extends to a depth of over 3 feet.

Both soil and subsoil of this type are subject to considerable variation, though none of the variations found is of sufficient extent or importance to be mapped as a phase.

Outcrops of sandstone are not uncommon, but they are not extensive and seldom interfere to any marked extent with cultivation. The depth to the underlying rock is variable, and while it averages considerably over 3 feet, there are places on the tops of ridges and

on knolls where there may be as little as 2 or 3 inches of soil. There are also places over gently rolling tracts where the soil has a depth of only 2 or 3 feet, but such areas are not extensive.

The Boone fine sandy loam is an important and fairly extensive type of soil in this county. Considerable areas are found in the towns of Cleveland, Hixton, Alma, and Springfield in the western part of the county, and also in the vicinity of Shamrock in the southern part. It is derived in part from decomposition of the sandstone rock underlying the county. This residual material has been mixed with varying quantities of the loessial silty material blown in by the wind.

This soil generally occupies the intermediate slopes lying between the high ridge lands and the sandy flats bordering some of the streams. The topography is gently undulating to rolling, some larger areas being nearly level, and some portions near the ridges and Rough stony land having a fairly rolling surface.

As a rule, this type withstands erosion well, because the soil can absorb much water quickly and because the surface is generally not very rolling. In a few places erosion has gotten beyond control, and bad ditches and ravines have been formed. Examples of these big ditches may be found along the Pine Hill road, 2 miles west of Shamrock.

On account of the sandy character of the soil and the surface features, the natural drainage of this type is excellent. Where the soil is shallow and where the slopes are steep the type frequently suffers from lack of sufficient moisture, though as a whole it retains moisture fairly well.

In origin the Boone fine sandy loam is largely residual, having been derived from the weathering of the Potsdam sandstone and from a shaly phase of this formation. On some of the slopes it is probable that some of the sandy material has been moved a short distance by washing. Where silty material is incorporated with the soil it is probable that a part of this has been washed down from higher lying silt loam types. Thus it will be seen that the type may also be partly of colluvial origin, though this variation is of minor importance. Sand dunes have been formed in a few places, but these are of small extent.

The original forest growth consisted partly of black oak and scrub oak, covering the shallow knolls and the lighter parts of the type. On the heavier parts there was some birch and maple. Sumac, hazel brush, poplar, and wild cherry form the second growth in uncultivated places.

By far the greater proportion of the type is put to some form of agricultural use, and most of it is cultivated. The wooded portion is confined chiefly to the steeper slopes and shallow knolls, which are

covered mainly with small oak. As is the case with the county as a whole, most of the type is devoted to general farming, with dairying as the most important branch. In connection with dairying quite a number of hogs are raised.

The chief crops grown and the ordinary yields are as follows: Corn, 40 to 50 bushels; oats, 30 to 40 bushels; barley, 35 to 40 bushels; and hay from 1 to 2 tons per acre. Some rye is also grown and gives fair yields. On some of the level areas of the type some farmers report an increasing difficulty in getting a good stand of clover. Others on the gently rolling areas report no trouble whatever, no clover having been lost in the last seven or eight years. Very fine stands of clover appear on some of the lighter parts of the type, even though the soil shows indications of acidity in response to the litmus-paper test.

When the county was first settled wheat was grown extensively on this soil, but very little is now produced. It is considered a fair corn soil, and the yields are practically the same as on the Union silt loam. Potatoes can be grown successfully, though the acreage is not large.

The rotation of crops most commonly practiced consists of corn, followed by oats or barley, with which clover and timothy are seeded. Hay is cut for one or two years, and the field may be pastured for a year before being again plowed for corn. Cultivation of this soil is not difficult, and a lighter class of implements and stock can be used than on the silt loam type.

The selling price of land of this type is quite variable, depending upon location, character of the surface, texture of the soil, and improvements. In the most favorable locations the gently sloping and nearly level portions of the type sell for \$60 to \$100 an acre. The rougher places which are more distantly removed from towns are held at \$25 to \$50 an acre.

BOONE LOAM.

The Boone loam consists of a grayish-brown loam or very fine sandy loam, 8 to 10 inches deep, over a yellowish-brown loam or sticky, clayey sandy loam subsoil. The subsoil is variable, being generally a compact sandy loam on the knolls and heavy loam or sandy clay loam on the slopes and the level areas. In some cases sand or sandstone is found at depths of less than 3 feet on knolls, but in most cases the heavy subsoil extends below the 3-foot soil section.

The soil is a gradation between the loessial Union silt loam and the more largely residual Boone fine sandy loam. It is generally distributed over the western half of the county and occupies gently undulating secondary slopes or valleys, or near-by level areas lying

between the higher land of heavier soil and the stream border areas of fine sand or fine sandy loam.

The topography is usually gently sloping or undulating, though portions are almost level. The drainage is nearly always good, owing to the topography. The only exceptions are in the drainage ways, or bordering lower ground, where small areas may be insufficiently drained at times.

The Boone loam is a valuable soil and is highly developed farm land. Practically all of it is under cultivation. Dairying and general farming are practiced on this soil. The crops grown include oats, barley, clover, corn, and some potatoes, wheat, and root crops.

Yields are about as follows: Corn, 50 to 70 bushels; oats, 30 to 40 bushels; wheat, 25 to 30 bushels; barley, 20 to 30 bushels per acre. Clover does well, but often freezes out in winter.

Improved land sells for from \$60 to \$90 an acre, depending chiefly on its location and improvements.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Boone loam:

Mechanical analyses of Boone loam.

Number.	Description.	Fine	Coarse	Medium	Fine	Very fine	Silt.	Clay.
		gravel.	sand.	sand.	sand.	sand.	Per cent.	Per cent.
312827.....	Soil.....	0.4	11.2	12.2	16.0	15.5	34.1	10.2
312828.....	Subsoil.....	.0	11.9	14.6	22.3	13.1	27.4	10.4

VESPER SANDY LOAM.

The surface soil of the Vesper sandy loam is variable, ranging from a fine sand and sandy loam to a sticky clayey sandy loam. The subsoil at 6 to 24 inches is a mottled or bluish clay loam containing sandstone or shale fragments of small size. In some cases white sand or sandstone rock lies at depths of 30 to 36 inches, but generally the soil is over 3 feet deep.

This soil is mapped chiefly south and east of Merrillan and covers a total area of about 3 square miles.

As is the case with the other Vesper types, this soil has been derived chiefly from the underlying sandstone and shale. It is all acid, and, after drainage is improved, it will usually require at least 3 tons of ground limestone per acre to correct this condition.

The drainage is often deficient because of the level topography and the impervious subsoil. Where the surface soil is more sandy, and the subsoil clay layer lies at 24 to 30 inches or below, this soil is not too wet to raise fair crops. Several small clearings are cultivated, and corn, beans, potatoes, and rye are grown.

VESPER FINE SANDY LOAM.

The surface soil of the Vesper fine sandy loam consists of 6 to 10 inches of grayish-brown fine sandy loam. In some places the surface 1 to 2 inches is dark brown or black, owing to a greater content of organic matter. The subsoil is a yellowish or mottled fine sandy loam or fine sand. At about 12 to 30 inches deep the subsoil becomes a stiff, compact, mottled, or bluish sandy clay loam or clay. This layer varies from 2 to 12 inches in thickness, beneath which is found sand, sandstone, or shale rock. The rock generally lies about 24 inches beneath the surface on the slight knolls, while on the flats and lower ground the surface is often somewhat sandier than usual, the clay layer thicker, and the rock lies at greater depths.

The Vesper fine sandy loam is an extensive type of soil. It lies in the northeastern part of the county in a compact body, 3 to 5 miles wide, extending from the vicinity of Hatfield east to City Point. Smaller areas occur near Merrillan.

The topography varies from flat to gently undulating. In a few places bordering streams the land is more rolling, but this condition is not at all extensive. The drainage of this soil is deficient. Because of the heavy clay layer and the shale rock beneath it, the rain water can not penetrate deeply into the soil. The result is a soggy, cold condition of the land till late in the season each spring. This is likely to be true, even on perceptible slopes. The drainage is better in a few instances on small knolls bordering the stream courses, and these are the places where crops are most successfully grown without additional drainage.

The drainage of sections 4, 5, 9, 10, 12, and 14, T. 22 N., R. 1 W., is better than the average, as they border the East Fork Black River. The Vesper fine sandy loam is largely brush covered. The original white and Norway pine timber has all been removed, and outside of a few oaks and jack pine there is very little large timber. Poplar, birch, jack pine, and oak brush cover most of the land. Willow, alder, moss, and sweet fern grow on the lower portions.

In origin this soil is largely residual from the underlying sandstone and shale.

Only a small proportion of the type is improved, and the land has a comparatively low selling value. By many it is considered as having limited possibilities, but demonstrations which have been made with the use of lime and with phosphate fertilizers seem to show that with drainage this soil can be made to produce profitable crops. Yields of corn of 60 bushels per acre are known to have been obtained. In the improvement of the type, drainage is of course the first step. The soil is low in organic matter and phosphorus and is in need of lime, but the supply of potassium is large, and this high

potassium content appears to be general. With proper drainage and fertilization, together with the use of lime, this soil appears to offer good opportunities for agricultural development.

The following table gives the results of mechanical analyses of samples of the soil, subsurface, and subsoil of the Vesper fine sandy loam:

Mechanical analyses of Vesper fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
312809.....	Soil.....	0.2	2.2	4.4	65.8	11.8	11.2	4.3
312810.....	Subsurface.....	.4	1.4	4.3	69.7	11.7	8.8	3.8
312810a.....	Subsoil.....	.6	1.0	.8	16.1	21.7	29.0	30.9

VESPER SILT LOAM.

The Vesper silt loam consists of 8 to 10 inches of grayish-brown, heavy silt loam on yellowish-brown, bluish, or mottled silty clay loam subsoil. This subsoil is sticky and retentive of moisture. Lenses of fine sand occur in the clay subsoil, and beneath this clay a layer of sand or sandy clay loam lies at from 24 to 36 inches. The sandy material lies nearest the surface on slight knolls, while on the flats and depressions the clay subsoil may extend to a depth of 4 feet or more. In a few places shale or sandstone rock is found within 3 or 4 feet of the surface on the knolls. On the flats 1 to 3 inches of the surface soil may be black with accumulated organic matter.

The Vesper silt loam covers about 5 to 6 square miles immediately to the north and west of Merrillan. It is not found in any other part of the county.

The usual topography of this soil is level or just perceptibly sloping. Very slight elevations or knolls occur in a few places north and northwest of Merrillan.

The drainage of the type is generally poor. This is due to the combined effects of a sticky clayey subsoil and the level topography. The drainage is so defective that cultivated crops can seldom be matured on it except in the driest seasons. The knolls mentioned are well enough drained so that the soil can generally be cultivated. Much of the land is retained in permanent pasture or hay land. A large part of this soil is still forested or brush covered. The original timber was largely pine, with some hemlock, and oak and other hard-woods. Practically all the merchantable timber has long since been removed. The present timber consists of oaks, poplar, ash, and birch, 15 to 20 feet high. Grass, willow, and alder cover the lower areas. The soil is very acid, and a good deal of moss grows on the cleared land.

The crops best adapted to this soil are hay (alsike and timothy), root crops, rye, and oats. Corn for ensilage can generally be grown, and in dry years ripe corn can sometimes be produced. Most of the cultivated crops are grown on the slightly higher knolls. Potatoes are grown to some extent, and also buckwheat. Yields of all crops except hay are very variable and depend almost entirely upon the character of the season.

This land sells for from \$10 to \$40 an acre, depending upon location and improvements.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Vesper silt loam:

Mechanical analyses of Vesper silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
312819.....	Soil.....	1.4	4.5	2.5	15.3	16.3	44.9	14.9
312820.....	Subsoil.....	.6	4.4	2.9	17.0	24.9	33.9	16.2

LINTONIA SILT LOAM.

The surface soil of the Lintonia silt loam, to an average depth of 10 inches, consists of a brownish-gray, friable silt loam which becomes lighter colored on drying and frequently has a whitish appearance. The quantity of organic matter present in the surface soil is comparatively small, and this accounts in part for the light color of the soil. A slight acid condition has developed in places in the surface soil, as indicated by the litmus-paper test. The subsoil consists of a yellowish-brown or buff-colored silt loam, which usually becomes somewhat heavier and more compact with depth and at 24 to 30 inches may be a silty clay loam. Below this depth there is often a considerable quantity of fine and very fine sand, and this mixture extends to a depth of 3 feet or more and grades into stratified fine sand, with layers of gravel in the lower depths.

The soil quite closely resembles the Union silt loam in texture and color, but differs from it in topography, origin, and the position which it occupies.

This soil occupies part of the highest levels of the terraces bordering the Black and Trempealeau Rivers.

A loam variation of this type occurs in two small areas; one directly south of Melrose and a larger one 4 miles northeast of Melrose, both bordering the north side of the river. The loam is slightly more subject to droughty conditions than is the silt loam, but the yields and crop adaptation are the same.

The material composing the Lintonia silt loam is largely of alluvial origin and was deposited during glacial periods, when the melting ice sheet greatly increased the volume of water flowing down these rivers. It is probable that the surface material, especially close to the foot of the bluffs, is partly colluvial, having been washed down the steep slopes from the Union silt loam areas, which are always found at higher elevations.

The surface of the Lintonia silt loam is usually level or nearly so, frequently having a gentle slope toward the stream channels along which it occurs. The type occurs as terraces, usually rather narrow, but extending along the streams for considerable distances. The part adjoining the upland rises slowly and frequently grades into the Union silt loam so gradually that the boundary line must be arbitrarily placed. As this type is found chiefly at the foot of considerably higher lying slopes, which are often very steep, large quantities of water must pass over the terraces during heavy rains, and as a result deep ravines are frequently formed.

The original forest growth on the Lintonia silt loam consisted chiefly of oak, with some hickory and a few other species. Most of the timber has been removed. In the ravines there is now a second growth of sumac, hazel, and other brush.

Practically all the type is put to some agricultural use, and most of it is cultivated regularly. The crops generally grown and the yields obtained are: Corn, 45 to 50 bushels; oats, 25 to 40 bushels; barley, 30 to 35 bushels; and hay, 1½ to 2 tons per acre. Potatoes are grown to a small extent for home use, but seldom on a commercial scale. The usual rotation consists of corn followed by a small grain, either oats or barley, or sometimes by one year of each of these crops, and then by clover and timothy mixed, seeded with the grain, the field being cut for hay one or two years before returning to corn. Stable manure is usually applied to the sod to be plowed under for the corn crops. The methods of cultivation, fertilization, and treatment are practically the same as those practiced on the Union silt loam. The soil is not difficult to cultivate, and where the areas are of sufficient size to form fields or the larger part of a farm, this terrace soil may be considered one of the most desirable types in the county.

PLAINFIELD SAND.

The typical soil of the Plainfield sand consists of a yellowish-brown sand of medium texture, extending to an average depth of 8 to 10 inches. The structure of the soil is loose and open, and there is present a considerable amount of iron, which gives the rusty color and a slight loaminess in places. It also carries a small quantity of organic matter, but the color indicates a higher content than actually

exists. A little gravel is seen upon the surface in some places, and a small quantity of fine gravel is mixed with the soil. The subsoil consists of a yellow medium sand which usually becomes coarser in texture with increase in depth. The subsoil always contains more gravel than the surface soil. Where the subsoil contains considerable iron, as is the case in spots where the drainage has been impeded for any reason, the material has a brownish or sometimes a reddish color, but this usually becomes less intense as the depth increases.

The Plainfield sand is located on flat-topped benches or terraces which rise abruptly from the Black River and extend back to the high bluff land on either side. In places the terraces are in several levels or steps, at intervals of from 15 to 40 feet in elevation, up from the river bottom to the land of the highest terrace, on which the residence portion of the city of Black River Falls stands. This terrace level extends several miles eastward along Morrison and Levis Creeks and narrows again to a narrow bench in Clark County, above Hatfield. In the southern end of the county only narrow strips of this soil are found in or bordering the river bottom. Narrow strips are also found in the Trempealeau River valley.

The topography is level, the only variations being where streams have cut across the terraces to the river bottom or at the abrupt rises from one terrace level to another.

Because of its generally loose and open character and the porous condition of the subsoil, this soil is generally well drained, and water passes through it so readily that crops are likely to suffer for lack of moisture in dry weather.

This soil is extensive in the central part of the county. Large parts of it remain uncultivated. The cultivated part is occupied largely by Polish people or Indians who cultivate small tracts. The vegetation of the uncultivated parts consists of small brushy trees, jack pine, Norway pine, poplar, birch, oak, and cherry. Sweet fern and blueberry brush cover the ground.

From 20 to 30 per cent of the type is cleared and has been cultivated at some time, but a considerable number of farms have been abandoned, and no crops are being grown upon them. The chief crops grown at the present time, and the yields secured during the most favorable years are as follows: Corn, 15 to 25 bushels; oats, 20 to 25 bushels; buckwheat, 12 to 16 bushels; and potatoes, 100 to 150 bushels per acre. Potatoes form the chief cash crop and do better than any of the other crops grown.

In a few cases white beans are grown on this soil and yield as high as 10 bushels per acre in favorable seasons. Cucumbers are grown to some extent in the vicinity of Hatfield. The yields of all crops vary with the character of the season and the treatment given the soil. Under most favorable conditions, fair yields of clover and

of mixed alsike clover and rye hay are obtained. Often most excellent corn is grown. But the failures of crops are frequent, and because of the poor pasture afforded this soil is not well adapted to dairy or general farming.

Some of the Polish farmers maintain a considerable number of young stock by grazing them over large areas of this brushy, undeveloped soil and on the flat shallow marshes which lie at the borders of this type. It is very difficult, however, to raise enough feed on this soil to keep any considerable number of cattle through the long winters.

Land is very cheap on most of this type. From \$6 to \$15 an acre represents the selling price of much of it. In the Trempealeau and South Beef River Valleys it is somewhat higher priced, owing to the presence of better soils in the vicinity.

PLAINFIELD FINE SAND.

The surface soil of the Plainfield fine sand consists of a brownish-gray or yellowish, loose fine sand, extending to a depth of about 8 inches. The surface 2 inches contains more organic matter, making it brown or dark brown in its virgin state. This is underlain by a yellow, loose fine sand, which extends to a depth of more than 3 feet. In texture, structure, and color this type is quite similar to the Boone fine sand, but differs from that type in origin and topography. Like the Boone fine sand, it contains only a very small quantity of organic matter and is in an acid condition.

This soil is practically all confined to the areas bordering Robinson Creek in the towns of Manchester and Millston. Like the Plainfield sand, it occupies the highest terrace level along the Black River valley and extends eastward in a practically level plain to Millston. The texture of the soil seems to be slightly coarser at the eastern end than at the western end of the area, but no definite boundary can be established, as the change is not uniform nor distinct.

Only a small part of this soil is under cultivation, the farms on it being confined to a small group near Shamrock, near Millston, and at Sandy Plains School. The greater part of the soil is covered with a second growth of jack pine, Norway pine, oak, poplar, white birch, and hazel brush. A few large white pines in the vicinity of Millston are the only remnants of an original Norway and white pine forest covering the area.

There are only a few farms under regular cultivation on this soil, and the farming is not yet of a very progressive kind. The farms are small, and large parts of the cleared area lie fallow or abandoned. The crops grown consist of rye, corn, buckwheat, and

potatoes. Where grass marshes and stream-bottom land adjoin this soil, it is possible to keep young stock and a few dairy cows. The soil is subject to drought and does not support a good quality of pasture when dry spells occur in the summer season.

In favorable seasons on new ground corn yields 20 to 25 bushels per acre; rye, 15 bushels; oats, 20 bushels. Potatoes yield 100 to 125 bushels. Beans and cucumbers are grown by some of the farmers. The raising of special cash crops is limited because of the hauling distances to the railroad and the sandy roads. Wild land sells for \$5 to \$10 an acre, improved land for \$20 to \$25.

PLAINFIELD SANDY LOAM.

The Plainfield sandy loam is a brown sandy loam, 16 to 18 inches deep, resting on a subsoil which becomes lighter in color, and if anything a little lighter in texture, with depth, and passes, usually at about 30 inches, into a yellowish sand. The lower part of the soil section thus resembles that of the Plainfield sand.

In Squaw Creek valley this soil is reddish or chocolate colored in places, indicating the presence of a great deal of iron due to a formerly poorly drained condition.

On a few small, isolated terraces near the bluffs and on elevated patches in the bottoms the surface soil is a fine sandy loam with a color slightly darker than typical. The subsoil is a yellowish-brown sticky sandy loam or sandy clay, underlain at 24 to 36 inches by a fine sand or sandy loam.

This type is not an extensive one. It is associated with the Plainfield sand and includes several small areas bordering the river bottom or tributary streams south of Black River Falls.

This soil is practically all under cultivation. Corn, potatoes, oats, and hay are the crops generally grown. The land is level, or very nearly so.

It is well drained and works easily, and is valuable agricultural soil. In yields and agricultural value the Plainfield sandy loam compares favorably with the Boone fine sandy loam.

DUNNING SAND.

The surface soil of the Dunning sand consists of brown to nearly black, medium or fine sand, 6 to 12 inches deep, containing a high percentage of organic matter which imparts to the soil its dark color. The subsoil consists of a grayish or whitish fine to medium sand which has a leached or washed appearance and extends to a depth considerably beyond 3 feet. In places the subsoil is stained yellow by iron oxide, and a bluish mottling is not uncommon. The depth of the surface soil varies considerably, but in other particulars the type is uniform.

The Dunning sand is confined to the sandy portion of the county east of Black River, and in mapping it was frequently made to include some of the land lying between the marshes and the Boone fine sand. The soil is not all black and not all distinctly flat marsh border land. Small areas of higher land in which the drainage is poor and grass swales and depressions are too numerous to separate, were included in the type.

The surface of the soil is always low and generally level. It is very little higher than the level of the marshes and slightly lower than the bordering sands of light color. On account of its low position and the nearness of the water table to the surface the natural drainage is poor, and as a result the type is too wet for ordinary farm crops, except during the dry part of the summer.

This type of soil is an extensive one in connection with the sand and marsh country of the eastern half of the county. Agriculturally it is not important, as the soil is generally too wet to raise crops, and very little of it is under cultivation.

Most of the type is covered with second-growth jack pine, poplar, and white birch, or a dense growth of willow and alder brush, with shallow grassy swales.

The Potsdam sandstone is the parent rock from which the Dunning sand was derived. It has been reworked, transported, and deposited by the action of water, but to what extent it is impossible to say. Under moist conditions it has acquired a black color through the growth and decay of vegetation. The whitish color of the subsoil may be due to the leaching of organic acids. All of the soil is in a very acid condition at the present time.

The native vegetation consists of jack pine, poplar, sweet fern, common ferns, mosses, bluestem, and several species of marsh grass. There is no timber of any value on the type at the present time.

As the type is low, poorly drained, and very acid, it is not cultivated except in a few places. It is devoted chiefly to the production of wild marsh hay and to pasture. Where cultivated, corn and buckwheat are the crops most grown. One farmer reported a yield of 40 bushels of corn and 150 bushels of potatoes per acre. Before this type can be farmed extensively it must be drained. The acid condition should then be corrected by the application of ground limestone. It would doubtless be found advisable to apply commercial fertilizers to supply the potash and phosphorus required by the crops.

GENESEE FINE SANDY LOAM.

The Genesee fine sandy loam occupies a large part of the bottom lands along the Black River. The soil occupies the same level as the Genesee silt loam, but usually lies on slight elevations from 1 to

4 or 5 feet above the silt loam. The soil is quite variable, owing to its manner of deposit and occasional overflow. The surface soil varies from a very fine sand to a heavy fine sandy loam or loam. The subsoil is generally more sandy than the surface. The color varies also from light brown to a chocolate or reddish brown.

This soil is in large part forested or brush-covered bottom land, but natural open areas or cleared portions are under cultivation. Generally occupying slightly higher elevations than the Genesee silt loam, it is not affected by the smaller floods, so that during many seasons parts of this soil can be cultivated. Good crops of corn, oats, and potatoes can be grown. This land can not well be permanently improved and protected from floods, however, so that its agricultural value is comparatively low.

The type includes several small areas of fine sand on the first-bottom land bordering the Black River south of Melrose. The fine sand is not extensive, and its agricultural value is low because of its being subject to frequent overflow. Its use is confined to pasture and woodlot purposes.

GENESEE SILT LOAM.

The Genesee silt loam occurs as first-bottom land along the larger streams and is subject to occasional overflow. The surface soil is generally a gray or drab silt loam, with a compact mottled or iron-stained silty clay loam subsoil. Sometimes the surface 2 or 3 inches of soil has a dark-brown color, due to greater quantities of organic matter.

The most extensive development of this soil occurs in the overflow lands bordering the Black River from the city of Black River Falls southward. Some was mapped along the Trempealeau River and its tributaries, which varies slightly from the type. Here the surface soil is a grayish-brown, heavy silt loam with a mottled, iron-stained, heavy silty clay subsoil. Included in this are small knolls of very fine sandy loam and sandy streaks along abandoned slough banks and water courses.

In sections 4 and 9, T. 20 N., R. 4 W., this soil lies on different levels, and parts of it less subject to overflow are cultivated. Grass and willow swales occur on the higher levels, where the soil is springy and wet.

The greater part of the Genesee silt loam bottoms is forested or brush covered. The trees consist of elms, ash, soft maple, birch, and willow. In a few places open areas occur where the vegetation is mainly grass or small brush.

The land is used largely for pasture land and woodlots. Some of the higher levels of small extent could be improved by tiling, but most

of the soil is too low and too much subject to overflow to be profitably drained.

WABASH LOAM, POORLY DRAINED PHASE.

The soil of the Wabash loam, poorly drained phase, is of alluvial origin, being situated in the valley bottoms bordering the streams and subject to more or less frequent overflow. The texture of the soil is not very uniform.

The surface soil of these bottoms is generally a dark-brown, drab or black loam or silt loam with a heavy mottled clay loam subsoil which, however, may have sandy layers in it. The surface soil also may be strewn with sand, gravel, and stones, and sandy layers may be encountered at any depth within the soil section.

This soil is found in a number of valley bottoms scattered through the western half of the county. The soil type is not extensive, as it comprises narrow strips of bottom only. Very little of the land is under cultivation, most of it being too low and wet. It is used almost entirely for pasture, as the soil occurs on the bottoms of the narrow valleys whose slopes are also often used for pasture.

WABASH SILT LOAM, POORLY DRAINED PHASE.

The Wabash silt loam, poorly drained phase, consists of alluvial deposits, chiefly along the upland streams. The areas are quite narrow, varying from strips too small to map up to areas one-half mile or so wide. Because of its stream deposition in narrow bands and the meandering of the streams, it is not very uniform. Generally it consists of a grayish or light-brown silt loam to about 18 inches, below which, to a depth of 3 feet, occurs a black, mucky, silty loam. In some places, however, these conditions may be reversed.

A variation from the general black or drab color of this soil is found along the Trempealeau River bottom near Taylor. There the surface soil is reddish brown or chocolate colored, owing to large quantities of iron in it. The area contains a general layer of spongy bog-iron ore at from 3 to 18 inches below the surface soil. This hard, chunky, or gravelly layer is 6 to 8 inches thick and is underlain by sand or mottled or reddish sandy clay loam.

This phase of the Wabash silt loam is widely distributed in the valley bottoms of the western half of the county. Because of its low position, it is not generally under cultivation.

Much of this land has poor drainage, and a good deal of it is subject to one or more overflows each year and consequently can not be depended upon for cultivation. It is used almost exclusively for pasture and hay land, for which it is especially valuable. Occasionally a fairly well drained patch is cropped. Corn does especially well on it, yields of 75 to 90 bushels per acre being reported.

Hay yields from 2 to 3 tons per acre. Owing to the narrowness of most of the areas and the low position of the land, it is doubtful if much of this phase could be successfully drained. Some of the broader expanses that have sufficient slope could be much improved by installing tile drains.

PEAT.

The material included in Peat consists of decaying vegetable matter in varying stages of decomposition, with which there has been incorporated in places a small amount of mineral matter. It is of a black or brown color and extends to a depth varying from a few inches to over 15 feet. The material underlying the greater part of such areas consists of fine sand.

This type of soil has been mapped as Peat where the surface layer of organic matter is from 18 inches to 3 feet or more thick, and as Peat, shallow phase, where the peat is from 6 to 18 inches deep.

This is one of the most extensive types of soil in the county. The largest areas are found in the eastern half of the county. The two towns bordering Wood and Juneau Counties are 75 per cent or more Peat soil.

Peat occurs also in narrow strips bordering the streams in the bottoms of the valleys of the western half of the county. Such areas are found in French Creek, Roaring Creek, and Tank Creek valleys.

The marsh land where Peat soil is found occupies the lowest ground and consists of nearly level grass-grown expanses, for the most part, however, with sufficient fall so that water flows in the drainage ditches where they are unobstructed. The Peat soil in its natural condition is all very wet, poorly drained, and acid. In parts of the eastern end of the county dredged ditches have been installed to drain the marshes or to carry water to the cranberry reservoirs, but comparatively little has been done to complete the drainage by means of lateral ditches or to tile-drain sufficiently to permit the soil to be cultivated continuously.

While Peat is an extensive type of soil in the county, its agricultural importance is limited. Some cultivation is being attempted, notably on Upper Trowe Marsh 4 miles north of Millston, on the Ring Marsh in sec. 24, T 21 N., R. 2 W., and on the Albright Marsh in secs. 30 and 31, T. 20 N., R. 1 E. In most attempts at cultivation the work is done on a large scale, and insufficient tile or lateral ditches are put in, so that crop failure is often experienced in wet years on the same land where large crops have been grown in a series of dry seasons.

Crops grown on this soil include buckwheat, rye, hay, potatoes, corn, root crops, cabbage, and onions.

The great majority of the marshes are used only for pasture, for the hay they produce, and where wooded, for the wood on them.

Sphagnum moss grows on many marshes, and quite an industry is established in the preparation of this product for market. From 20 to 30 cars of sphagnum moss are shipped from Mather (Juneau County) each year. The moss is collected by long-toothed rakes operated by hand, cured, and packed in bales weighing about 30 pounds each. The price is about 50 cents per bale in Chicago. The moss is used by nurserymen and florists. It takes from three to four years for a marsh to renew itself after moss has been collected. Since the drainage of the marshes much of the moss has been destroyed by fires. The owner of the marsh usually receives 50 cents per ton for the moss, and the work is done by men who make a business of gathering moss.

In a few cases moss gathering is carried on in connection with the cranberry business, and quite complete equipment, such as narrow-gauge tracks, drying beds, baling and storage sheds, and presses, is maintained.

The growing of cranberries was at one time an extensive industry, but many of the marshes have been destroyed by fire and the acreage greatly reduced. Practically all of the marshes remaining have been set out. A successful cranberry marsh must be so situated that the water supply can be controlled. The crop is subject to damage from frost, and during the dry summer months there is great danger from fire. The industry, therefore, is a speculative one. The cost of establishing cranberries is considerable. Scalping a peat bed costs from \$30 to \$75 per acre, sanding about \$90, and setting about \$32. Vines are usually secured from trimmings, but if bought they cost about \$100 per acre. The weeding the second and third year on sanded marsh costs \$10, and on Peat \$20 per acre. These are prewar prices. Full crops are seldom secured until four years after setting. It costs about \$1 per bushel to pick and prepare the berries for market. One bog in the year 1911 yielded 555 bushels per acre. When \$2 per bushel is secured such a yield is very profitable. Yields of this size are seldom secured oftener than once in five years, and many marshes never produce such large crops. Where there is absolute control of water and the best methods of culture are followed, the speculative feature is largely removed.

The common varieties of berries grown are called natives. These are small but hardy berries. McFarland Prolific and Early Ohio are larger varieties not so generally grown.

About 12 or 13 cranberry marshes are in operation in the county. The acreage under cultivation varies from 1 to 40 acres or more. About 6 to 12 acres of actual cranberry beds is a good-sized marsh.

A large area is necessary to supply the needed water for flooding and reservoir purposes, so that each marsh when fully equipped represents a considerable acreage of land. A complete outfit includes also a house for the manager or owner, several houses for the help, a sorting and packing room or building, and a frost-proof storage building for storing the crop in barrels till it can be marketed.

Where thoroughly drained and cultivated, very good yields of a number of crops can be grown on Peat soil. It is generally found, however, that after several crops have been removed the soil must be supplied with manure or with commercial fertilizers containing potash and phosphorus in order to keep up the yield. While it is high in organic matter and nitrogen, Peat soil generally lacks a sufficient supply of the mineral elements mentioned.

The development of this soil is hampered by the great distance from railroads and the poor roads, and also by the fact that this cheap land is held in large blocks for cranberry raising or for speculative purposes. This soil can be made to produce valuable special crops, such as potatoes, onions, celery, root crops, and other crops, as is being done at Valley Junction, in Monroe County, and south of Mather, in Juneau County. In most cases from \$15 to \$30 an acre must be invested to drain the Peat completely for these crops.

Peat soil sells all the way from \$4 to \$10 an acre for wild land, up to \$30 and \$40 for partly developed land.

Peat, shallow phase.—The shallow phase of Peat includes those areas in which the surface layer of organic matter is from 6 to 18 inches deep. In general, there is more of the black, well-decomposed material in the shallow phase than in the areas where the surface layer is deeper. The vegetation and drainage conditions in this phase are the same as in the typical Peat.

ROUGH STONY LAND.

Rough stony land includes rock exposures, cliffs, and land which is too steep and rough to plow or cultivate. It may be considered nonagricultural, as it is of value only for the small amount of timber and pasture it supplies.

This type occupies a large part of the steep walls bordering the valleys and forms a border between the valley bottoms and the high land of the ridges. The type is developed as narrow bands, many miles in extent, winding in and out of the valleys and coves, but confined to the steep slopes. A part of the type occurs as narrow ridges upon which areas of soil too small to be mapped are sometimes found. The bluffs and cliffs are highest along the western border of the county and frequently reach an elevation of 200 to

300 feet above the valley bottoms along the sides of which they occur. The ridge tops are also wider here than elsewhere and range in width from one-fourth to one-half mile. The elevation of the ridge tops ranges from 150 to 200 feet above the valley floor throughout most of the interior of the western part of the county.

The Rough stony land type also includes isolated mounds, hills, and ridges of sandstone rocks rising above the comparatively level plain of the eastern part of the county. None of these rough stony areas, such as Saddle Mound, Bruce Mound, or Stanley Mound, have any tillable land on their summits.

Rough stony land is quite uniformly distributed throughout the western part of the county and is intimately associated with Union silt loam and the steep phase of that type, and also with some of the Boone types.

The greater part of the rock consists of the Potsdam sandstone, although there is also some granite rock exposed along the bed of the Black River.

The forest growth still remaining consists of white oak, red oak, pine, hickory, and a considerable quantity of undergrowth and brush in places. The best timber has all been removed, and what now remains serves to protect the slopes from washing.

The inclusion of Rough stony land in farms reduces the value of better land and it renders the fields on or beyond the ridges less accessible. It makes hauling to market more difficult, as some of the roads cross steep strips of this class of land.

SUMMARY.

Jackson County is located in the west-central part of Wisconsin and comprises 1,001 square miles, or 640,640 acres. It may be divided roughly into two distinct topographical and agricultural regions. The part west of the Black River is to a considerable extent a rough, rolling country, with soil of good quality predominating and an agriculture which is highly developed. East of the Black River the region is largely an extensive sandy plain, with the predominating soil of low agricultural value, but slightly improved.

While the first settlement was made as early as 1818 or 1819, there was but little in the way of agricultural development prior to 1850. The county was established in 1853, and the village of Black River Falls was incorporated in 1866. All of the western part of the county is now well settled, but the eastern part has a very sparse population.

Two railway systems traverse the area and provide transportation facilities for the region, although some portions of the county are quite distant from shipping points. From Black River Falls to

Madison it is 127 miles, to Chicago it is 250 miles, and to Minneapolis it is 152 miles. These distances are over the Chicago, St. Paul, Minneapolis & Omaha line.

The mean annual temperature is about 43.8° F., and the mean annual precipitation 31.6 inches. The marshy region in the eastern part of the county is much more likely to have summer frosts than the hill country to the west.

Agriculture is well developed in the western part of the county, and the region is in a prosperous condition, while in the eastern part there is but little development, owing to the low agricultural value of the soils.

Jackson County lies almost entirely within the unglaciated part of the State, and the soils have been derived from the disintegration of the underlying sandstone and shale and also from the wind-blown material known as loess. In addition, there are large tracts which have been modified by the action of water and deposited in the form of stream terraces or valley fill. Accumulations of vegetable matter have given rise to extensive bodies of Peat, and smaller accumulations of organic matter have modified several of the various soil formations.

Nine soil series are represented in Jackson County. Including Peat and Rough stony land, 19 types of soils were recognized and mapped.

The Union silt loam is a light-colored upland soil, largely of loessial origin, and is an extensive type in the western part of the county. The surface varies from level to rolling, and the drainage is good. Grain growing and dairying are the leading industries. Cattle and hogs for the market are raised in connection with dairying. The steep phase of this type is subject to erosion and is somewhat droughty. It is used for about the same crops as the typical soil, but more of it remains forested or is in pasture.

The Bates silt loam is a brown upland soil with a rather high content of organic matter. It occurs in one area in the northern part of the county. The surface is level to undulating, and the drainage is generally good. This type is especially good for corn. Dairying is the chief industry, accompanied by hog raising and the production of some beef cattle.

The Boone fine sand, a residual soil derived from sandstone, covers the greater part of the upland in the eastern half of the county, but is found in all parts. The soil contains very little organic matter and is loose and droughty. Yields of crops are generally low and vary greatly with the location, the season, and the manner of handling the soil. Special crops, such as beans, cucumbers, and tobacco, are grown successfully on this type in some localities.

The Boone fine sandy loam is found in the western and southern parts of the county. The surface varies from nearly level to rolling, and the drainage is excellent. Most of this type is under cultivation and produces good yields of the common crops, such as corn, oats, barley, and hay. Dairying is the most important industry and is accompanied by hog raising.

The Boone loam is a gradation between the Union silt loam and the Boone fine sandy loam, with which it is closely associated. The surface is nearly level to undulating, and the drainage is usually good. Practically all of the type is cultivated and produces good yields of the general crops common to this county. Dairying is an important branch of farming on this soil.

The Vesper sandy loam is of very limited extent and agriculturally unimportant. Most of it is in forest.

The Vesper fine sandy loam occurs in a compact body in the north-eastern part of the county. The soil is cold and backward because of deficient underdrainage and has a low selling value. It is mostly covered with brush.

The Vesper silt loam is of limited extent. Because of poor drainage it is too cold and wet for cultivated crops except in very dry seasons. Much of it is forested or brush covered, and some of it is in pasture or hay land.

The Lintonia silt loam occurs in narrow strips on the highest terraces and is closely associated with the Union silt loam. Most of it is used in agriculture. It is not difficult to cultivate, and it produces excellent yields of corn, oats, barley, and hay.

The Plainfield sand is located on flat-topped terraces. Only a small part of it is in use. It is porous and consequently droughty in dry weather, and the yields of general crops are very uncertain. Potatoes are the most dependable and productive crop on this soil.

The Plainfield fine sand is a terrace soil very similar to the Plainfield sand. Most of it is covered with second-growth trees and brush, and only a little is in farms. It is droughty, and yields of most crops are low. Potatoes are the best crop.

The Plainfield sandy loam is a brown sandy loam, passing gradually into the typical sandy subsoil of the Plainfield series. It is not extensive, but is practically all under cultivation. It is well drained, works easily, and produces good yields of corn, potatoes, oats, and hay.

The Dunning sand is a dark-colored soil containing a high content of organic matter. It is closely associated with the marsh and sand areas in the eastern part of the county. It is low and flat and is usually too wet for ordinary farm crops. Much of it is covered with second-growth trees and brush. The type is used chiefly as pasture and for the production of wild hay.

The Genesee fine sandy loam is a light-colored first-bottom soil subject to occasional overflows. Much of it is covered with forest or brush. Some of it is cultivated, and good crops of corn, oats, and potatoes can be grown when not damaged by overflow. The principal use of the type is for pasture and woodlot.

The Genesee silt loam usually lies a little lower than the Genesee fine sandy loam, and most of it is subject to frequent overflow. The greater part of it is forested or brush covered. The type is used chiefly as woodlot and pasture.

The Wabash loam, poorly drained phase, is a dark-colored first-bottom soil subject to frequent overflow. It is generally too low and wet for cultivation and is used almost entirely for pasture.

The Wabash silt loam, poorly drained phase, is widely distributed in the valley bottoms of the western part of the county. Most of it has poor drainage and is overflowed each year. It is especially valuable for pasture and hay. Heavy yields of corn are obtained on occasional fairly well drained patches.

Peat is found in all parts of the county, but occurs most extensively in the eastern part. The type consists chiefly of grass-grown marshes with a surface layer of decaying vegetable matter from a few inches to 15 feet deep. Small drained areas produce good crops in dry seasons. Much of the type is used for hay or pasture. Some moss is gathered and shipped. Cranberry growing is an important industry. This type, when thoroughly drained and properly handled, is well suited to the growing of root and truck crops.

Rough stony land consists of land which is too rough or too stony to be cultivated. It may be considered as nonagricultural.



[PUBLIC RESOLUTION--No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in Wisconsin, shown by shading.

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